Preliminary Information Collection Report

Ignition/Firing Techniques

2006 WFSTAR Hot Topic

For: Wildland Fire Lessons Learned Center
C/O The National Advanced Fire & Resource Institute
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The Guidance Group provides strategic services to fire service organizations and specializes in leadership, strategy and organizational improvement. The Guidance Group provides a unique blend of real world fire management experience as well as facilitative and consulting skills that may not be available within the client organization. The result is a practical, professional and experienced approach to fire service strategy, leadership and organizational needs including strategic planning; professional development; goal setting; collaborative problem solving; program evaluation; and support to field studies and field research.

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TABLE OF CONTENTS

I. Introduction

This Information Collection Report is the initial product in a project to describe and document lessons learned, effective practices, and innovative ways of overcoming challenges pertaining to ignition and firing. This report includes only limited or key lessons learned, practices, and challenges that seem appropriate for inclusion on the Wildland Fire Safety Training Annual Refresher (WFSTAR) website. Additional information will be included in a full project report still in development.

Instructors of Annual Wildland Fire Safety Refresher Training are encouraged to utilize this report, and the information documented in it, as a Hot Topic during Annual Wildland Fire Safety Refresher Training sessions.

II. Methodology, Assumptions and Limitations

An experienced interviewer contacted and interviewed, by phone, six subject matter experts (SME) to collect information that may be of value to others. The intent is to help fire management personnel reproduce successes and avoid recurrent mistakes. Identifying lessons learned, effective practices, and innovative ways of overcoming challenges, with respect to safety, remained the sole focus of the interviews. This report documents selected opinions of six subject matter experts, and is not intended as a comprehensive, definitive assessment of the state of the discipline. The subject matter experts interviewed include experienced Burn Bosses, Ignition Specialists and Firing Bosses.

The LLC is interested in the "what," not the "who"; and, in the interest of confidentiality, the interviewer did not attribute remarks to the person interviewed by name, unit or other identifier in this document.

At the time this project was completed the National Wildfire Coordinating Group (NWCG) was in the process of revising the Wildland Fire & Prescribed Fire Qualification System Guide (310-1) to eliminate the Position of "Ignition Specialist" in favor of "Firing Boss." However, this change is not yet commonly known within the interagency workforce. In addition, several of the subject matter experts interviewed reported on experiences they had while engaged in positions other than Firing Boss. Consequently, this report identifies people who lead ignition efforts as Ignition Specialist/Firing Boss.

III. Lessons Learned

Most Safety Issues Can Be Mitigated With Good Planning

Background:

It is said that good planning leads to smooth operations. Nowhere is this more true than when agencies employ fire as a tool, whether prescribed or when firing during fire suppression operations.

Lesson Learned:

When applying this principle to the prescribed fire environment, good planning begins with programmatic planning; actions that take place two years or more before burn day. Experienced Burn Bosses and Ignition Specialists/Firing Bosses recommend planning a wide variety of burns to maximize the available burning windows that the organization can take advantage of. Once the burning organization has planned burns on different aspects, at different elevations, and in a variety of fuel types, they can pick burn units that are most appropriate for the time of year. Not only can good programmatic planning, as described here, mitigate the many safety concerns associated with trying to burn units under adverse conditions, but also it helps accomplish burning targets when narrow prescription or air quality windows are a factor.

Good programmatic planning can mitigate safety concerns by having a variety of burns planned and ready to go, effectively preparing the burning organization to select units that are most appropriate for the time of year, thereby lessening the need or temptation to push the envelop to accomplish a burn under adverse conditions.

In addition to good programmatic planning, experienced Burn Bosses and Ignition Specialists/Firing Bosses also stress the need for individual burn unit planning to mitigate firefighter safety issues before any matches are struck. The Burn Boss and Ignition Specialist/Firing Boss must physically inspect the burn unit, with a primary focus on identifying actions that must be accomplished in preparation; including mechanical thinning along control lines, pile burning within the unit boundaries, snag cutting, etc. The essence of this concept is that the burning organization can mitigate safety hazards by planning or engineering them out of the project long before striking the match, rather than expecting firefighters to mitigate safety concerns while engaged in the burning operations.

Pay Attention To The Basics

Background:

Experienced Burn Bosses and Ignition Specialists/Firing Bosses agree that, whether it is because we are fighting fire in the interface, working under the rotors of a helicopter, or racing to squeeze a burn in through a narrow window, our sense of urgency too often drives-out our attention to fundamental safety practices during ignition and firing operations.

Lesson Learned:

The experts have learned to:

- Have a well prepared plan before they start

- Assure a thorough, quality briefing, particularly when a variety of people are operating on the ground. Everyone must maintain their situational awareness, including understanding the layout of the burn unit or operating area, and remaining crystal clear on where they are and what they are doing and where others are, what they are doing, and when. Enabling people to maintain full situational awareness requires the burning organization to provide good maps and give a thorough, quality briefing. Everybody should have a map and everyone must be briefed.

  Ironically, igniters, the people who may need the best briefing, often receive the most abbreviated briefing. Experienced Ignition Specialists/Firing Bosses recommend conducting an additional breakout/briefing for igniters only, during which they benefit from plenty of opportunity for discussion and questions.

- Physically inspect the burn area before starting. These experts do not rely on a map or second-hand information. In prescribed burn situations, physically inspect the unit one to two weeks in advance of burn day. Look for potential problem areas; think about exactly how you will ignite and exactly how you will hold the resulting fire.

- Establish an anchor point before ignition and tie the burn to it.

- Use lookouts and holding personnel as a source of information and feedback for the Ignition Specialist/Firing Boss. Their observations can be critical, such as fire behavior that the Ignition Specialist/Firing Boss cannot see, any observed change in weather conditions (especially wind speed or direction), the quality of burn (is your burn working and meeting objectives?), and to report and size-up of spots and/or slopovers. When holding personnel report that a spot fire has occurred, require a thorough

size-up (location, how far the spot is off the line, fuel type, fire behavior, resources committed and required, etc.) Lookouts and holding personnel need to be prepared to contribute in this way. Make the responsibility clear, and encourage communication up the chain.

Test Burns Matter

Background:

It is safe to say that most agencies require a test burn as part of their prescribed fire policy and procedures. Unfortunately, people are observing that, too often, people are conducting test burns only because the test burn is required. Those who are simply going through the motions to comply with the rules are likely missing the benefits of this valuable tool. Depending on where the Ignition Specialist/Firing Boss chooses to conduct the test burn and how well they monitor it, the test burn can provide a lot of information, allowing the burning organization to predict whether they will produce a positive outcome.

Lesson Learned:

Experienced Burn Bosses and Ignition Specialists/Firing Bosses advise that when burning a unit with multiple fuel types or variable terrain, the burning organization should ignite multiple test burns. One experienced Ignition Specialist/Firing Boss offers the following technique for conducting multiple test fires.

- Drop one “blob” of fire in the most receptive fuel type and observe the fire’s behavior as you let it spread.
- Drop another “blob” of fire in the least receptive fuel type and observe this fire’s behavior as you let it spread.
- Pay attention to rate-of-spread, what is consumed, and how these fires evolve.
- If possible, observe how the fires interact. If not, observe the fires with an eye toward how fire in the different fuel types will interact or how fire will transition from one fuel type to the other.

Experienced Firefighters Not Experienced Igniters

Lesson Learned:

On a recent prescribed burn, one experienced burner was glad that he had experienced firefighters working as the ignition team, but quickly learned that experienced as a firefighter does not necessarily mean qualified as an igniter. In a situation like this, new igniters need very clear direction and astute supervision that continues even after they seem to be getting it. When working with developing igniters, bring them together occasionally and discuss lessons learned during the operation. Tighten-up supervision when approaching potential problem areas, make sure the ignition team knows they are approaching a potential trouble spot, and that they know what to do.

Equip Aerial Ignition Helicopters With GPS Recorders

Background:

The Alberta (Canada) Department of Sustainable Resource Development recently began equipping its aerial ignition helicopters with Global Positioning System (GPS) recorders. These recorders provide several benefits.

Lesson Learned:

First, the Albertans recognize the importance of communicating with the general public to develop and maintain support for the their aerial ignition program. For example, during fire suppression efforts, the public predictably asks, “Why are you putting more fire on the ground?” and the recorders provide data that enables Albertan fire personnel to better communicate the benefits of aerial ignition. In addition, the possibility always exists that a property owner will feel that backfiring operations, rather than the wildfire, has damaged their property. The recorders provide the Albertans with the opportunity to show precisely where they applied aerial ignition. The recorders also provide an excellent training and organizational learning tool. Each year, Alberta’s 14 Aerial Ignition Specialists meet for an annual after action review and training conference, and the data from the GPS recorders is reviewed there.

Become a "Learning Organization"

Background:

More and more, we hear firefighters decry the current operating environment as the age of checklists. They often lament that checklists and a rules-driven approach to their work have constrained their ability to adapt, react, and make decisions based on their experience and professional judgment.

Lesson Learned:

Increasingly, experienced Burn Bosses and Ignition Specialists/Firing Bosses are calling for a new approach, one of becoming a "learning organization." Learning organizations are those skilled at creating, acquiring, interpreting and transferring knowledge and at purposefully modifying their behavior to reflect new knowledge and insights.

These experienced burners recognize that a fundamental step to becoming a learning organization is to adopt the after action review (AAR) methodology, as a way of reviewing the experience of each burn they conduct. Most experienced burners recognize that each fire is unique, with unique decisions needed and that new experiences are gained with each burn. These experts capture this experience using the AAR process to feed experience from one burning operation into planning for the next one. They conduct an AAR following every operational period, and communicate significant issues identified in the AAR upward, to influence departmental policy and procedure.

IV. Effective Practices

Burning On High Energy Slopes

Background:

When burning on high-energy slopes, the potential for unexpected or unwanted fire behavior and resulting control problems are always a concern.

Effective Practice:

Experienced Burn Bosses and Ignition Specialists/Firing Bosses use the following practices to mitigate the fire behavior, control, and safety concerns associated with burning high-energy slopes that may be drier, hotter, or have more fuel than normal.

- Schedule ignition on high energy slopes early in the season as soon as those slopes come into prescription
- Ensure that prep work mitigates the potential for unwanted fire behavior
- Blackline units on high-energy slopes to reduce control problems
- Consider using late evening or night ignition
- Curtail burning when observed fire behavior during the test fire indicates fire behavior other than what is desired
- For prescribed fire operations, jackpot larger fuel concentrations during the shoulder seasons. On fire suppression assignments, jackpot large fuel concentrations at night

Avoiding Excessive Fire Intensity Associated With Strip Head Fires

Background:

Many factors, including the need to accomplish acreage targets during limited burning windows, often lead Ignition Specialists/Firing Bosses to use strip head fires, even when that ignition pattern will produce undesirable fire behavior and intensity. On prescribed fires, this excessive intensity can produce undesirable fire effects. Excessive fire behavior and intensity also, of course, causes unwanted control problems during both prescribed burning and fire suppression operations.

Effective Practice:

Expert burners offer the following practices to avoid excessive fire intensity associated with strip head firing.

- Use late afternoon, evening, and night black lining and jackpot burning to reduce fire behavior and intensity in units that will be strip head fired

- Moderate fire intensity by controlling ignition timing and speed

- Consider night ignition

- Assure that the Ignition Specialist/Firing Boss controls the ignition pattern during the ignition of steep or high-energy slopes. Along that line, one expert burner offers the following ignition technique as a means for avoiding excessive fire intensity that can result from strip head firing.

  When using hand ignition, this burner likes to use spot ignition, producing an effect similar to that produced by aerial ignition with the ping-pong ball machine (Premo MK III Aerial Ignition Device) vs. the traditional strip ignition technique. Using this technique, the igniters can, and may, still work along a strip or line, but they only ignite spots vs. laying down a continuous line of fire. Employing this ignition pattern, the Ignition Specialist/Firing Boss allows multiple spots to come together to form a line of fire, better mimicking natural fire behavior, producing better fire effects, allowing wildlife escape routes, and reducing unnatural fire intensity that sometimes results as two continuous strips come together.

  When igniting this way, it is important to emphasize to the igniters that they are to ignite the fuels by dropping spots of fire, and that they can judge their success by monitoring their fuel use. Noting that this ignition technique should make an igniter's fuel supply last longer, this experienced Ignition Specialist/Firing Boss tells their igniters "If you're running out of fuel, you're probably not doing this right."

When employing this technique, the burning organization is trying to accomplish, on the ground, what they typically achieve from the air; effectively working as human ping-pong ball machines.

Use Propane Torches Rather Than Drip Torches

Effective Practice:

One experienced Ignition Specialist/Firing Boss, having worked for years on a big logging activity fuels district, recommends propane torches mounted on pack boards over drip torches for all burning. Propane torches are cleaner and avoid the mixed fuel mess that often collects in vehicles, avoid fuel mixing issues associated with drip torches, and steers clear of the problem of firefighters soaking their PPE with fuel.

Aerial Ignition Tactics During Suppression Operations

Background:

Alberta (Canada) Sustainable Resource Development is making a big push towards aerial ignition, both for prescribed fire and fire suppression. In the Boreal forests of Alberta, heavy fuel loadings, highly flammable fuels, and ever-present ladder fuels limit the practicality of hand ignition from the ground, and aerial ignition allows the Albertans to avoid placing ground personnel at risk under these conditions.

Effective Practice:

Unlike other agencies that typically use aerial ignition during fire suppression during project fires, Alberta uses aerial ignition on initial attack. The Alberta experience includes two effective aerial ignition practices; building control line using aerial ignition and lifting the smoke column to improve visibility for air tankers and other aircraft.

In 2002, on the House Creek Fire in Northern Alberta, responding to a lack of available ground resources, an incident management team (IMT) employed three aerial ignition helicopters to establish 30 miles (50 Kilometers) of fireline during a single afternoon. Though the line was eventually lost, the action provided an effective temporary control measure, bought the IMT considerable time, and allowed them to focus their attention on other control priorities elsewhere.

The Alberta approach requires their Aerial Ignition Specialists, who are on-board the helicopter, to show competence using aerial ignition to turn or lift the smoke column to improve visibility for airtankers and helitankers operating on the fire.

Beyond Briefings – Describing Your Intent

Effective Practice:

One experienced burner points out the importance of describing your intent, as the leader of the ignition effort. He describes the practice as being so much more than a complete and thorough briefing, and points out that every assumption you make provides an opportunity for a misunderstanding or mistake. When describing leader's intent, you must communicate to the ignition and holding teams what they will be doing, how, why, and most importantly, what it should look like when done right.

V. Innovative Approaches To Overcoming Challenges

Lighting More Fire Than The Organization Can Control

Challenge:

Expert burners agree that they have been presented with their greatest challenges when the burning organization has lit more fire than they can control. This problem occurs both during aerial and ground ignition, and experienced Ignition Specialists/Firing Bosses cite examples of getting too much fire on the ground during both ignition modes.

Several expert burners believe that their closest calls have come when aerial ignition devices were misused or over-used and aerial ignition helicopters applied too much fire to the burn area very quickly. One expert believes that people consistently underestimate how much fire they can put on the ground when employing aerial ignition. Others point out that the over-application of fire results from impatience and a failure to recognize and anticipate the lag time that occurs between dispensing fuel, using the sphere dispenser, and the development of fire on the ground.

However, another experienced Ignition Specialist/Firing Boss finds that smaller units, typically lit by hand, can actually prove more difficult, because small units offer fewer margins for error and are less forgiving.

Solutions:

- If you are the Burn Boss or Ignition Specialist/Firing Boss, you really need to know your burn unit or operating area very well.
- A highly experienced Ignition Specialist/Firing Boss must supervise aerial ignition operations.
- During aerial ignition, assure that people on the ground, who can assess the aerial ignition performance, are in communication with the helicopter and Ignition Specialist/Firing Boss.
- If the ignition teams are laying down too much fire, and you are not the Ignition Specialist/Firing Boss or Burn Boss, tactfully but assertively express your concerns to the Ignition Specialist/Firing Boss or Burn Boss and, most importantly, *offer solutions*.

Snags And Snag Safety

Challenge:

Snags and snag safety present a critical concern for ignition and firing teams both on prescribed fires and during wildfire suppression operations. Snags remain a major cause of firefighter injury and fatality, and will remain so in the future.

Solutions

Expert burners offer the following practices as ways to mitigate the exposure of ignition and firing teams to the hazards posed by snags.

- Minimize snag exposure through planning. Incorporate snag reconnaissance into the planning for all units to exclude large and dangerous concentrations of snags

- In areas or situations where snag concentrations cannot be excluded from the burn area, snag mitigation measures must be identified in the burn plan or Incident Action Plan (IAP), and mitigation measures must be completed before implementing the burning operation

- Develop a thorough snag Job Hazard Analysis (JHA), use the JHA to develop the IAP, and review the JHA during the operational briefing. Use the JHA template for working in the vicinity of hazard trees endorsed by the Federal Fire and Aviation Safety Team (FFAST). The JHA template is located on the FFAST website at http://www.nifc.gov/safety_study/ffast.html.

- Consider alternative fuel treatments in high snag risk areas, such as burning following logging

- Examine the use of agency hazardous tree guidelines, used in other areas of the agency mission (i.e. recreation, facilities management), as a tool for planning burn preparation

- Consider using contracted professional fallers to mitigate snag hazards when the workload exceeds the capability or availability of agency resources

Declining Experience Gained By Burning

Challenge:

Agency employees used to gain substantial fire experience by working on prescribed burns. When the agencies burned a lot of activity fuels, people were able to see a lot of fire and fire behavior under relatively controlled circumstances, and learned to think on their feet. The agencies are losing this training ground because they are burning less, and the burns they are doing are often very large, landscape scale burns, lit from the air, that present few learning opportunities for the people on the ground.

Solutions:

Establish local interagency burning groups that cooperatively burn on each other's lands. This approach not only provides opportunities to work in an interagency environment, but also provides people with opportunities to work in local, representative fuel types that they will fight fire in during fire season. Take much greater advantage of interagency partnerships including statewide working groups, county mitigation cooperatives, and local interagency players.

Wind Overcoming the Effects of Slope

Challenge:

When local winds overcome the effects of slope, firing specialists are faced with a special challenge that requires changes to ignition techniques and patterns. The ability to recognize this situation is critical.

Solution:

Participate on lots of fires, both suppression and prescribed, and become a student of fire behavior. Firefighters have many opportunities to watch and learn. Instead of hurrying-up and waiting; hurry-up and watch.

The Outsider Brought In To Implement A Burn Plan

Challenge:

When you are an outside expert, brought in to the local unit to implement burn plans, you are faced with a particular challenge. The outsider does not know the people and, consequently, cannot interpret those important human factors. They do not know the topography, fuels or weather well.

As the expert, you have the ability, and responsibility, to suspend or delay burning operations when you find an element of the plan that makes you uncomfortable. However, delaying the local unit's burn can present an enormous challenge, when the local unit goes to the effort and expense to bring you in.

Solutions:

- Be prepared to face this challenge by developing a personal wealth of experience on which to draw. Increase and broaden your experience by accepting assignments in a variety of locations, fuel types, and conditions.

- Pay attention to details. Do not make assumptions; or if you do, at least recognize that every assumption you make can lead to misunderstandings and mistakes.

- If uncomfortable with an element of the plan, decline respectfully. Say "I am not comfortable with the plan for the following reasons. Offer alternatives and solutions.

- When the agency administrator or other local unit personnel say, "We went to all this expense and effort to bring you here, and now you want to delay our burn by a day?" the answer must be "Yes, and here's why."
- Remember that people respect you and your ability, which is why they brought you in. Stand your ground. While they may not be happy, they will accept your judgment.

Communicating with Rappel Aircraft

Challenge:

Alberta Sustainable Resource Development makes extensive use of both heli-rappellers and aerial ignition helicopters on initial attack. During their deployment, the rappel helicopters go onto a “blind” (discreet) frequency to allow the pilot to concentrate solely on deploying the rappellers. Consequently, the rappel helicopters are out of radio contact with aerial ignition helicopters and other aircraft for up to 15 minutes.

Solutions:

To overcome this challenge, the Albertans emphasize a dispatch system that allows all personnel to know what aviation resources have been dispatched, what aviation assets are en-route or on-site, and stresses the responsibility for aircrews to make contact with one another prior to arriving on-scene and/or switching to blind channels. Albertan Ignition Specialists and aircrews are extremely conscious of what other aircraft are in the area and their assignment.

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